

NATIONAL BUREAU OF STANDARDS REPORT

9608

Development, Testing, and Evaluation of Visual Landing Aids
Consolidated Progress Report for the Period April 1 to June 30, 1967.

By
Photometry Section
Optics Metrology Branch
Metrology Division
Institute for Basic Standards



U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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² Located at Boulder, Colorado, 80302.

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NBS PROJECT

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NBS REPORT

9608

August 31, 1967

Development, Testing, and Evaluation of Visual Landing Aids

Consolidated Progress Report to

Ship Installations Division
and
Meteorological Division
Naval Air Systems Command
Department of the Navy
and to
Federal Aviation Administration

For the Period
April 1 to June 30, 1967

By
Photometry Section
Optics Metrology Branch
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U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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Development, Testing, and Evaluation of Visual Landing Aids
April 1 to June 30, 1967

I. REPORTS ISSUED

<u>Report No.</u>	<u>Title</u>
9350	Photometric Characteristics of U. S. Airport Lights
9506	Arcata Field Tests for Atmospheric Backscatter Signature Studies
9540	Development, Testing, and Evaluation of Visual Landing Aids, Consolidated Progress Report for Period January 1 to March 31, 1967
212.11P-8/67	Photometric Tests of a Stabilized Glide Path Indicator
212.11-20/67	Luminous Output and Life Tests of Ten Developmental 210-Watt, 6.6-Ampere, T-14 Airport Lamps
212.11-21/67	Photometric Tests of a Type CD-100 Condenser-Discharge Approach Light with a Louvered Metal Shield
212.11-23/67	Photometric Tests of an Angle-of-Approach Light
Memo Report	Early Drift in Sensitivity of Type CE-75 Phototubes

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II. VISIBILITY METERS AND THEIR APPLICATION

Shipboard Visibility Meter.

Construction of the power supply and electronics boxes of the shipboard visibility meter has been completed. Both have had an individual check of wiring, and all power supplies are operative. The lamp-photocell assembly is still under construction. Nearly all mechanical work has been completed and the unit is being wired. Inter-connecting cables are being completed and final testing of the electronics box will be made as soon as these are available.

A current overload circuit has been built to monitor the photo-multiplier current. If the anode current exceeds a preset value, the circuit will remove the high voltage from the tube and light an overload indicator lamp. The circuit must be reset manually and will not reset if the overload is still present.

A system could be designed to switch back to operate automatically, and also choose between the day and night operating modes. This would be significantly more complicated and does not seem advisable for this model.

The system will be ready for outdoor testing during the next quarter.

Fog Detector Field Tests.

There were no fog detectors at Arcata during this period. Hence, no testing in the field was performed. Some revisions were made in the report of the field tests of the backscatter fog detectors developed by the Hoffman Electronic Corporation. One or more fog detectors will be installed at Arcata for field testing during this fog season.

Transmissometers.

Some transmissometer indicators have a gradual zero shift when the pulse meter reading is low. There is a decreasing reading which may continue for 20 minutes or longer. The shift may be as much as five percent of full scale in some cases. Other units do not show this characteristic. The reason for this zero shift has not been definitely determined but appears to result from one of the capacitors in the grid circuit of V202 developing a semipermanent charge which gradually leaks off when the signal is low. In one indicator, capacitors C203 and C204 were replaced and this zero shift was eliminated. This shift does not affect runway visual range (RVR), which is based on the actual pulse count, but would affect the runway visibility (RVV) (which is read from a meter) and any information obtained from the chart records unless a zero correction is made.

A memorandum report describing drifts in the sensitivities of phototubes recently purchased by the National Bureau of Standards has been prepared and released.

Fog Variability Studies.

Additional data collected for the fog variability studies has been reduced. The transmissometers were kept in operation with only minimum maintenance.

Restricted visibility conditions at the Arcata Airport for the months of April, May, and June, as recorded by the elapsed time meters, were as follows:

Instrument flight rules (IFR)	565 hours
Runway lights operated at step 5 intensity	55 "
Transmissivity below 0.5 over a 500-foot baseline in daytime	35 "
Transmissivity below 0.5 over a 500-foot baseline at night	78 "

These values show nearly twice as many hours of IFR conditions and runway light operation at step 5 for this quarter as for the first three months of the year but only about two-thirds as many hours with transmittance less than 0.5.

Sperry-Rand Visibility Meter Field Tests.

NBS Report 9506 reporting the work of the Arcata Field Laboratory during the field studies of the laser backscatter visibility meter has been released.

III. AIRFIELD LIGHTING AND MARKING

Airfield Lighting Cable Connector Field Tests.

Current-leakage tests were made on the 13 cable connectors being tested in the continuing field tests. These tests were made in May near the end of the wet season, when the earth was saturated. Over the past 30 months the leakage current had increased by an average factor of three. Part of this leakage may be in the cable leads between the connectors and the guard ring and not in the connectors. These connectors have been installed for the test for eight years.

Field Tests of Type L-842 Inset Runway Lights with Forced Drainage Modification.

Five type L-842 inset runway lights were mounted in a test installation. The foundation is a concrete pad 6 inches by 24 inches by 128 inches adjacent to the concrete parking apron. The five lights were mounted along the axis of the concrete pad with the light centers on 24-inch spacings. Two of the light assemblies were standard. Three light assemblies had been modified to include a sump in the bottom of the lamp compartment; a tube was installed in the wall of each light assembly from the bottom of the sump to the top of the wall outside the gasket surrounding the lamp compartment. The purpose of this modification is to permit the pressure developed when the lamp is energized to force out any water which may have accumulated in the compartment. The lights are connected in series and operate at rated current for three hours each day. The lights will be opened for inspection after operating in the controlled test for several months.

Improved Cable Fault-Locating Set.

Construction of the new cable fault-locating set has been completed. Upon completion of performance testing in the laboratory the set will be sent to Arcata for field testing. A report giving operating instructions, circuit and construction details, and performance characteristics is being prepared.

Improved Heliport Perimeter Light.

A type M-1 light housing was modified to permit vertical adjustment of the lamp and socket to achieve a higher elevation of the beam. The work is toward the development of an improved heliport perimeter light. Photometric measurements of the unit with various lamps will be made.

Model of an Open-Grid Approach Light.

Some work was done in determining the proper position of the three type PAR-36 lamps to be used in the model of the open-grid approach light, but the completion of the work was postponed in favor of more urgent work.

Compilation of Intensity Distribution Data.

NBS Report 9350, Compilation of Intensity Distribution of Airport Light, was issued. A supplemental report giving data on carrier landing lights will be issued later this year.

Type CD-100 Condenser-Discharge Approach Light with a Louvered Metal Shield.

Photometric tests were made of a type CD-100 condenser-discharge approach light with a louvered metal shield intended for use when the light is used as a runway-end identifier. NBS Test Report 212.11-21/67 was issued. Figures 8 and 10 of that report are included herewith as figures 1 and 2.

20-Ampere, 500-Watt "Night Vision Floodlight."

Photometric measurements were made of a "night vision floodlight" manufactured by the L. C. Doane Company. The light uses a single 20-ampere, 500-watt PAR-56 type lamp. One 14-inch and one 24-inch hood were furnished. An analysis was made to determine the suitability of using lights of this type for floodlighting the maintenance area of a SATS landing system. The calculated illuminance on the horizontal surface is shown in figure 3. NBS Test Report 212.11-26/67 will be issued.

Centerline Light for the SATS System.

Photometric measurements and water leakage tests were made of a centerline light for use in a SATS runway. When tested as received the unit showed a peak intensity at about 15° vertical and a secondary peak at about 3° vertical. An examination of the light showed that the secondary peak was from the main beam of the light while the peak at 15° was a reflection from the enameled bottom of the light channel. Further examination showed that the filament of the lamp was high (assuming the seal of the lamp is to be placed in a downward direction). Two other lamps gave peak intensities of 860\ candelas and 1000 candelas at 3° vertical. The light leaked water but it was not "factory fresh" when tested; one lens had been removed and replaced several times, as had the relamping insert. NBS Test Report 212.11-28/67 will be issued.

Q6.6A/PAR56/2 Approach Light Lamps.

Eight Q6.6A/PAR56/2 approach light lamps were tested and put on life test. This 1000-hour life lamp is intended to replace the conventional filament 200-watt, 6.6-ampere lamp of 300-hour life. All eight lamps essentially meet the requirements of MS24348. The average peak intensity was 17.7 kilocandelas. For seven of the lamps the "requirement" isocandela pattern was shifted 1° downward, the maximum allowable. The isocandela patterns of several lamps were skewed from the lamp axes. See figure 4.. Since the requirements of MS24348 allow a shift up, down, left or right of the isocandela curves, but not skewing of the curves, it is difficult from the samples tested to suggest possible changes to MS24348.

The lamps were put on life test.

NBS Test Report 212.11-22/67 will be issued.

Developmental 210-Watt, 6.6-Ampere, T-14 Bulb Airport Lamps.

NBS Test Report 212.11-20/67 was issued giving the results of luminous output measurements and life test of ten developmental 210-watt, 6.6-ampere, T-14 bulb airport lamps. The design life is 300 hours. Average luminous output (initial) was 4690 lumens; average life was 431 hours; lumen maintenance of one lamp after 462 hours was 88%. It was suggested in the report that the definition of the life of a series lamp in specification MIL-L-6363D be modified to read "or until the voltage drop across the lamp falls below 95% of the initial voltage drop."

"Factory-Aimed" Type PAR-64 Iodine-Cycle VASI Lamps.

Eight of the eleven "factory-aimed" type PAR-64 iodine-cycle VASI lamps were put on life test. The first burn-out was at 2925 hours. The average life will be slightly over 3500 hours; the design life was stated to be 2000 hours.

In view of the longer-than-design life of this group of lamps, the manufacturer was notified. He changed his filament parameters and submitted another group of lamps for test. Color temperature measurements of one lamp of the new group indicated a temperature of 3040°K. This suggests a 2000-hour life. Average intensity of the

"upper peak"* was 37.1 kilocandelas against 28.3 kilocandelas for the group of eleven lamps for which the life test previously mentioned applies.

*This is the position of the red portion of the beam but in the test a clear spread lens was substituted for the red spread lens.

IV. CARRIER LIGHTING AIDS

Stabilized Glide Path Indicator.

NBS Report 212.11-8/67 was issued giving results of measurements made of a Stabilized Glide Path Indicator manufactured by the General Electric Company (England).

Bulova Angle-of-Approach Light.

Photometric tests were made of a Model 101 (GAIL) angle-of-approach light manufactured by the Bulova Watch Company.

The unit tested is intended for use as a portable light to indicate a safe glide plane for aircraft approaching landing areas. The unit is a small three-color sector light having a red "too-low" sector, a green "on glide-path" sector, and a yellow "too-high" sector. The light is operated by ten 1.25-volt nickel-cadmium cells connected in series to power a 10-watt, 8-volt type 10S11SC signal lamp. A projection lens, a condensing lens, a formed auxiliary reflector, and a tricolor plane glass filter complete the optical system. An external sight with two transverse vertical wires is provided to aim the unit horizontally and to examine the glide path for obstructions.

NBS Test Report 212.11-23/67 was issued. Figure 2 from that report is included herewith as figure 5.

V. MISCELLANEOUS TECHNICAL AND CONSULTIVE SERVICES

Review of Proposed Specifications.

The following proposed specifications have been reviewed:

MIL-T-26898B Airfield Lighting Systems Test Set, Type MM-1
MIL-L-4993B Airfield Lighting 5000-Volt Electrical Lead Assemblies
MIL-C-5136C Buna Compound Insulated, Polychloroprene Sheathed
Electrical Power Cable

A meeting was attended with members of the "Regulator Working Group" (Navy and FAA personnel) to discuss a new specification for constant current regulators for airport lighting applications.

VI. MISCELLANEOUS

Proposed Tests of Fog Dispersal.

Ram-Jet Wind Incorporated report that they plan to test a "Ram-Jet"-operated wind machine at Arcata Airport during this fog season if the equipment can be prepared and arrangements for testing are approved. This would be only a limited test of a mobile type unit to determine its ability to disperse fog. The firm has expressed interest in our assistance in determining visibility during the tests.

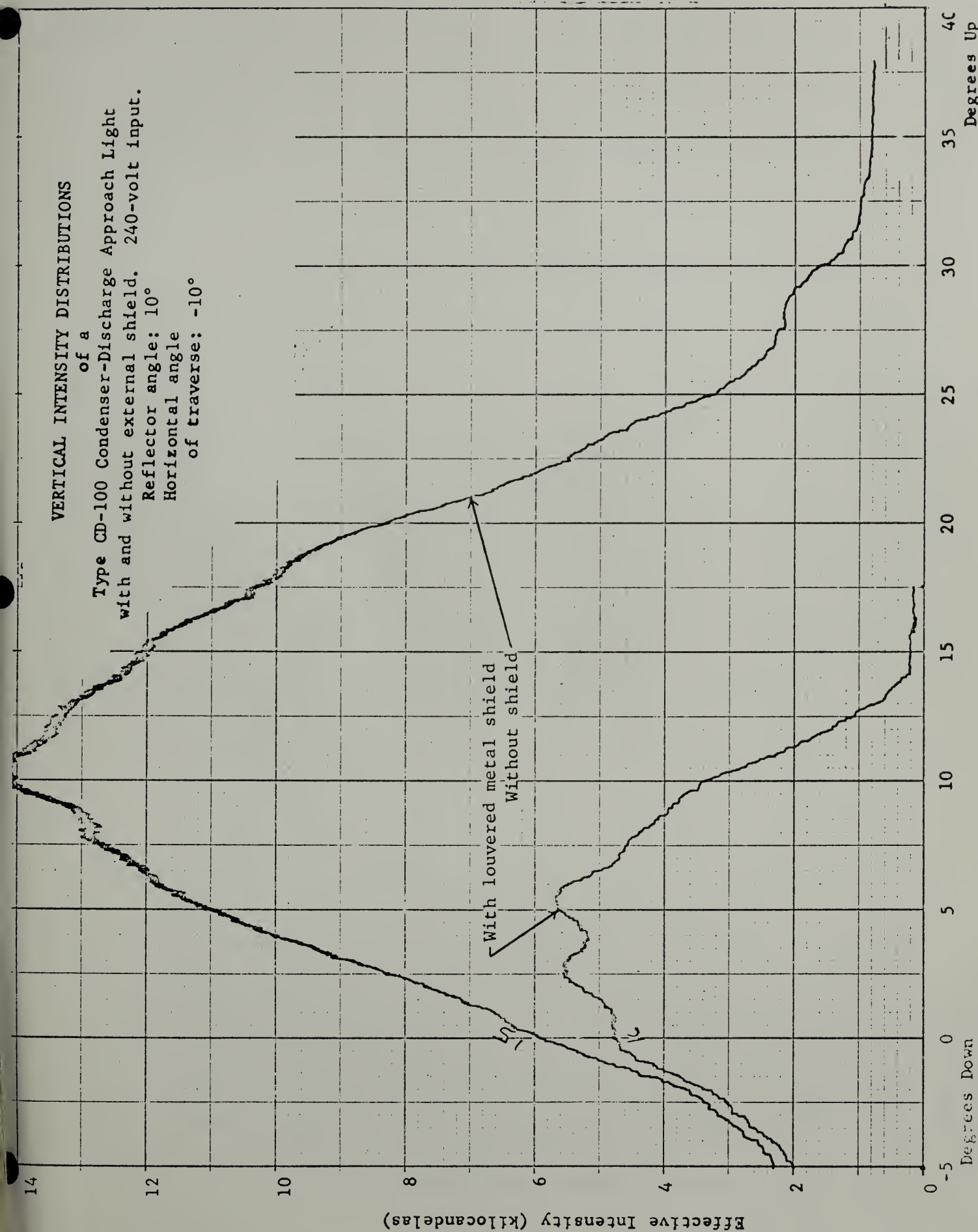
VERTICAL INTENSITY DISTRIBUTIONS

of a

Type CD-100 Condenser-Discharge Approach Light
with and without external shield. 240-volt input.

Reflector angle: 10°

Horizontal angle
of traverse: -10°



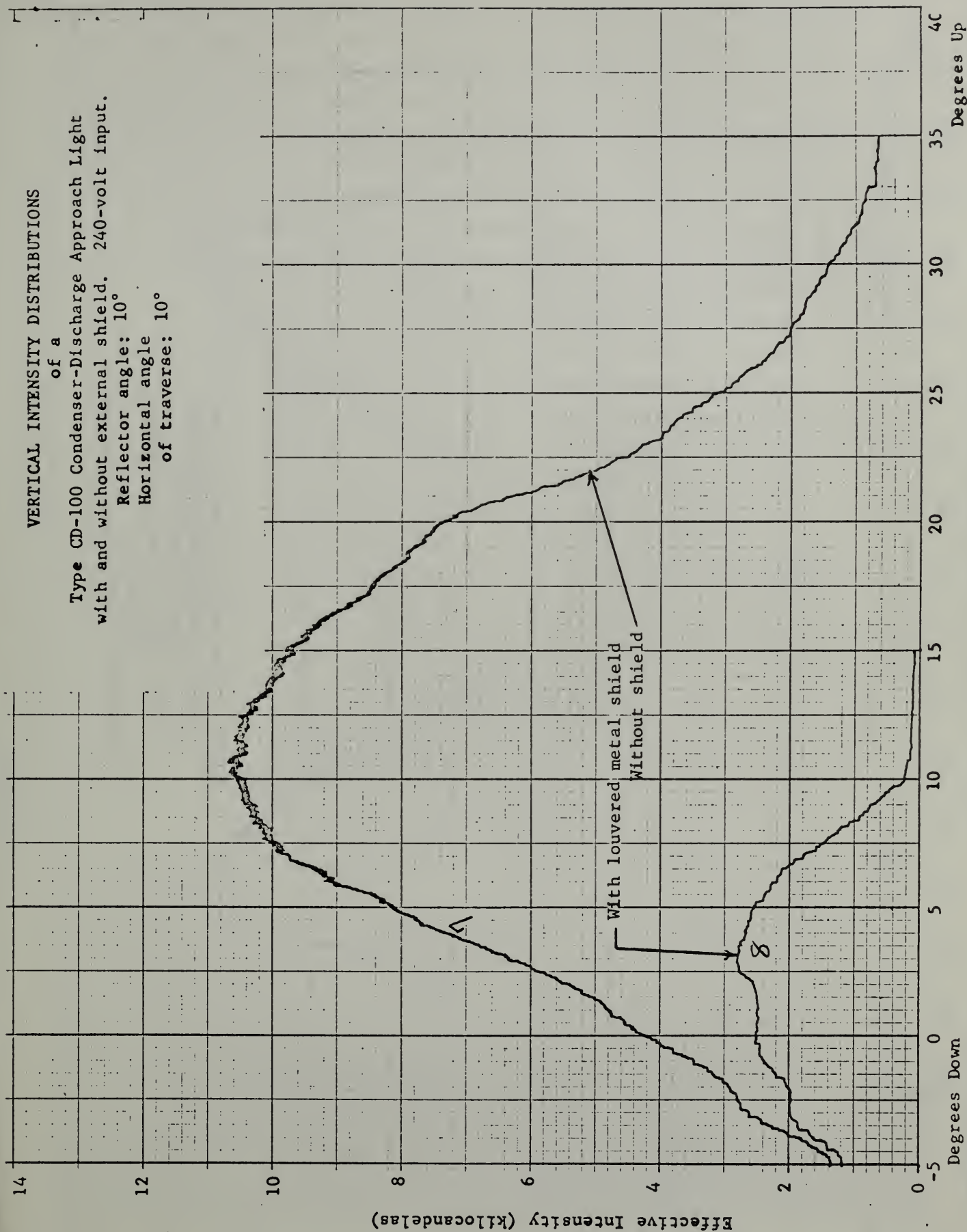
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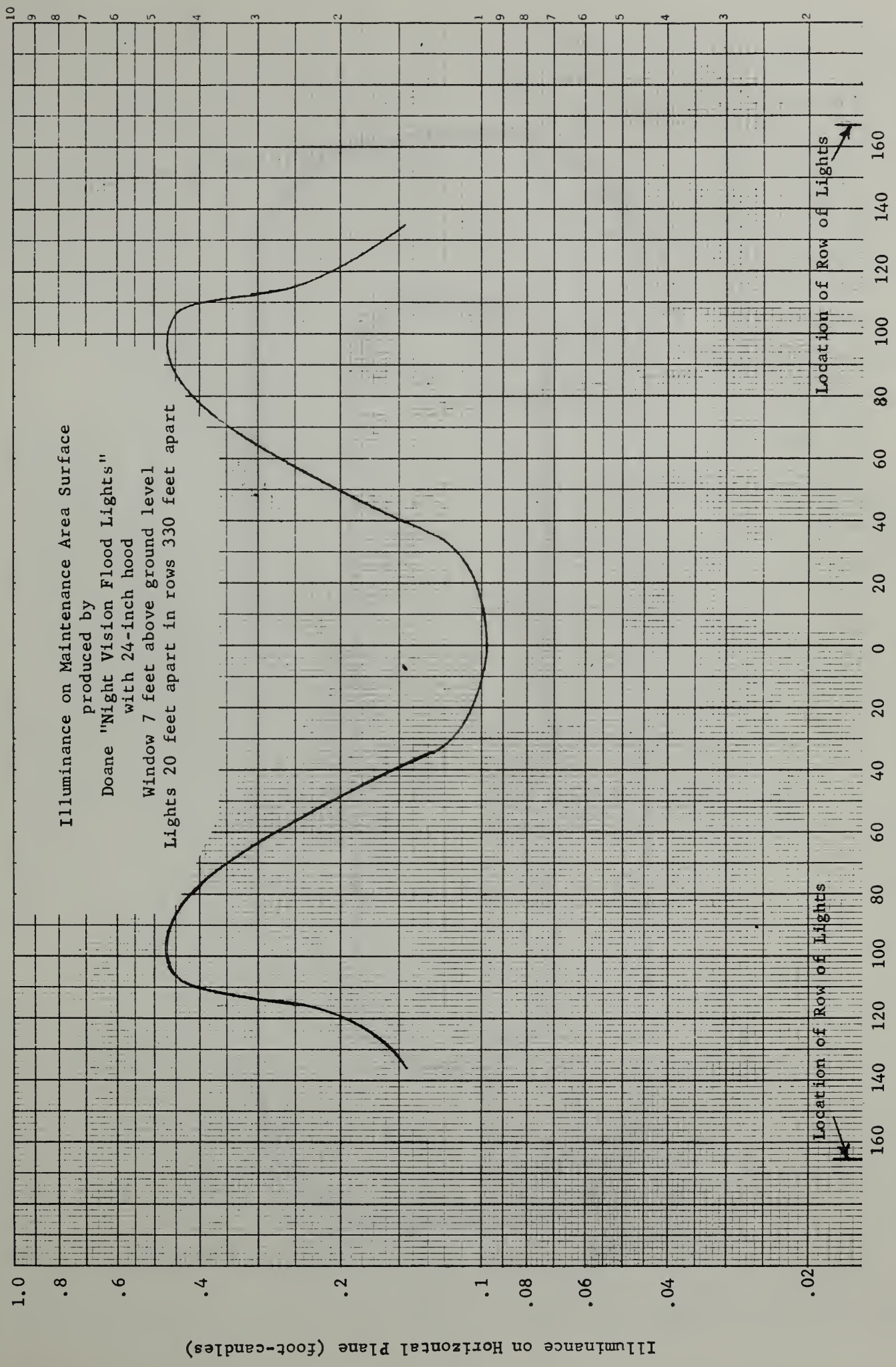
of a

Type CD-100 Condenser-Discharge Approach Light
with and without external shield. 240-volt input.

Reflector angle: 10°

Horizontal angle
of traverse: 10°





NBS Report 9608

Figure 3

ISOCANDELA PATTERN OF A 200-WATT, 6.6-AMPERE
 TYPE Q6.6A/PAR56/2 AIRPORT APPROACH LAMP
 Manufactured by The General Electric Co.
 Lamp #4 Peak intensity: 17.0 kilocandelas

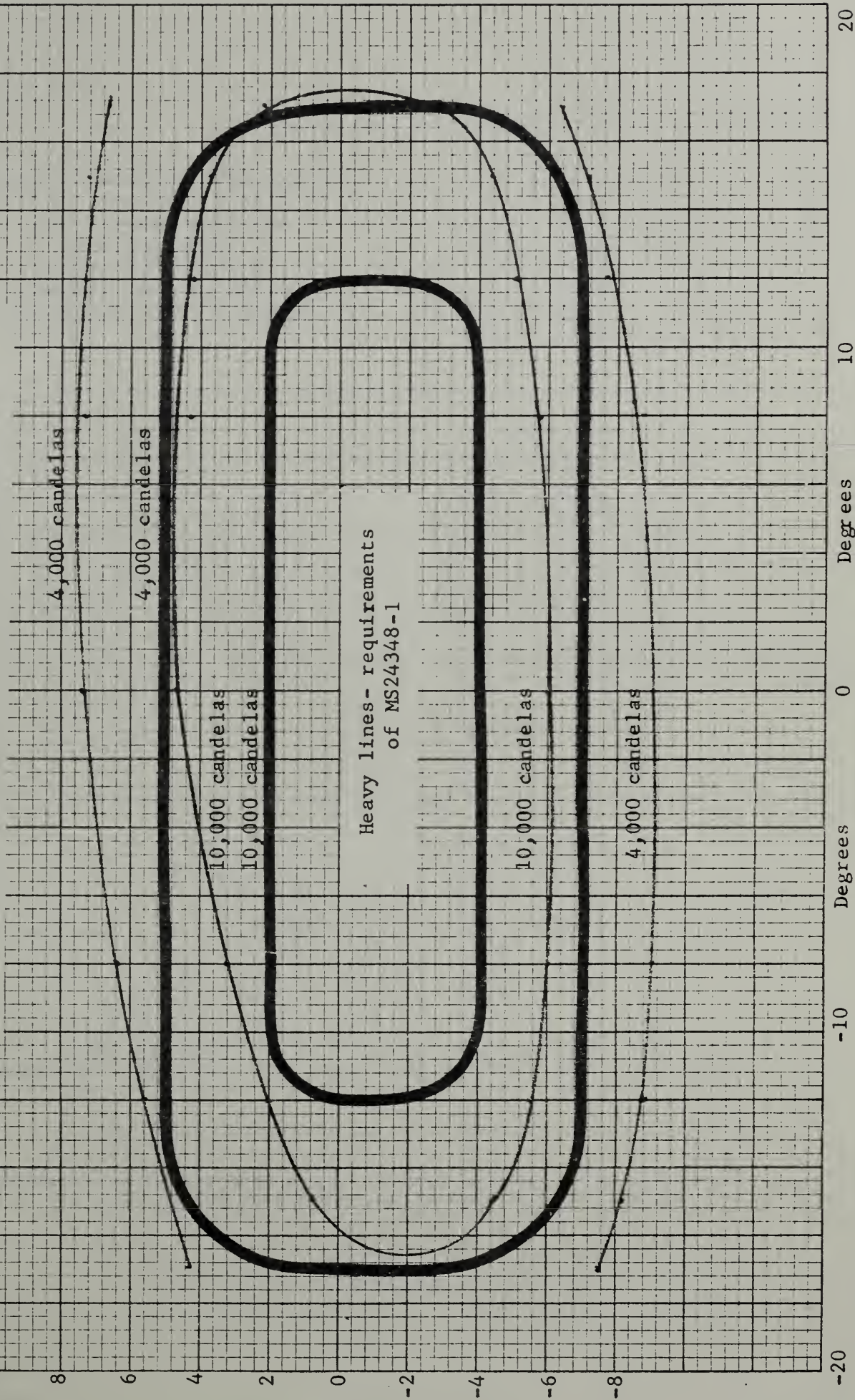


Figure 4

